

REMARKS

Reconsideration of this application is respectfully requested in view of the foregoing amendments and the following remarks.

As a preliminary matter, the Applicants appreciate the indication of allowable subject matter in claims 16 and 17 of the present application.

By the foregoing amendments, claims 1 and 14 have been amended and claim 13 has been canceled without prejudice or disclaimer. Thus, claims 1-12 and 14-24 are currently pending in the application and subject to examination.

In the Office Action mailed July 21, 2004, the Examiner rejected claims 1-12 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,369,622 to Lim et al. The Examiner also rejected claims 13-14 under 35 U.S.C. § 103(a) as being unpatentable over Lim et al. in view of U.S. Patent No. 6,545,481 to Emberty et al. The Examiner also rejected claims 15 and 18-22 under 35 U.S.C. § 103(a) as being unpatentable over Lim et al. in view of U.S. Patent No. 6,100,731 to Otaka and further in view of Emberty et al. The Examiner also rejected claim 23 under 35 U.S.C. § 103(a) as being unpatentable over Lim et al. in view of U.S. Patent No. 6,072,374 to Takahashi. Finally, the Examiner rejected claim 24 under 35 U.S.C. § 103(a) as being unpatentable over Lim et al. in view of U.S. Patent No. 4,658,323 to Dougherty.

It is noted that claim 13 has been canceled, and claims 1 and 14 have been amended. To the extent that the rejections remain applicable to the claims currently pending, the Applicant hereby traverses the rejection, as follows.

It is submitted that none of the cited prior art, nor combination thereof, discloses or suggests at least the features of a frequency multiplier comprising a phase shift

section for generating at least one phase shift signal for a fundamental signal, a waveform combining section for generating a combined waveform by combining signal waveforms of the same polarity obtained by wave-rectifying the fundamental signal and the phase shift signal, and a comparator section for comparing the combined waveform with a comparison threshold value, as recited in claim 1, as amended. The signals of the same polarity are waveform-combined and compared with a comparison threshold value, resulting in the output of a frequency-multiplied signal. The waveform of the frequency-multiplied signal of the present invention is thus outputted as a logical signal having a multiplied frequency by rectifying and combining the fundamental signal and the phase-shifted signal, both being alternating signals and different in phase, to provide signal waveforms of the same polarity, and comparing the resulting combined signal with the comparison threshold value in the comparator section and multiplying the frequency of the signal.

Lim et al. discloses that the "RC-CR phase shifter or splitter network 121 . . . provides at nodes B and C two low pass filtered, phase-shifted signals having the same frequency as the clock signal at node A . . . , which are 90° apart." See column 2, lines 45-49; see also Figure 1. In addition, Lim et al. discloses that the "voltage comparators 131, 132 are used to convert these rounded signals at nodes B and C into corresponding 90° phase-shifted square-wave pulses . . ." and that "XOR gate or combiner 141 provides an output clock signal CLK_O with twice the input clock frequency . . ." See column 3, lines 48-50 and 53-55. Thus, the multiplied frequency signal in Lim et al. is obtained by logical calculation of square-wave pulses different in phase in, e.g., the XOR gate.

Based on the foregoing, the Applicants respectfully submit that neither Lim et al., nor any of the other cited art or combination thereof, teaches or suggests the features of a frequency multiplier comprising a phase shift section for generating at least one phase shift signal for a fundamental signal, a waveform combining section for generating a combined waveform by combining signal waveforms of the same polarity obtained by wave-rectifying the fundamental signal and the phase shift signal, and a comparator section for comparing the combined waveform with a comparison threshold value, as recited in claim 1, as amended.

For at least these reasons, the Applicants submit that claim 1, as amended, is allowable over the cited prior art. As claim 1 is allowable over the cited prior art, the Applicants submit that claims 2-12 and 14-24, which depend from allowable claim 1, are allowable over the cited prior art for at least the same reasons as allowable claim 1.

Furthermore, Applicants respectfully submit that none of the cited prior art, nor combination thereof, discloses or suggests at least the features of a frequency multiplier comprising a phase shift section for generating at least one phase shift signal for a fundamental signal, a waveform combining section for generating a combined waveform by combining signal waveforms of the same polarity obtained by wave-rectifying the fundamental signal and the phase shift signal, a comparator section for comparing the combined waveform with a comparison threshold value, and a level shift section for shifting amplitude levels of at least any one of the fundamental signal and the phase shift signal prior to the generation of the combined waveform, as recited in claim 2, depending from amended claim 1 of the present invention. Accordingly, in the present invention, it is possible to change a wave height value of each signal providing the combined waveform

and hence switch the oscillation duty and frequency-multiplication number of the frequency-multiplied signal.

Lim et al. discloses shifting a signal level of an input signal. This appears to be intended to adjust the signal level to an input voltage range of a subsequent circuit.

Based on the foregoing, the Applicants respectfully submit that neither Lim et al., nor any of the other cited art or combination thereof, teaches or suggests at least the features of a frequency multiplier comprising a phase shift section for generating at least one phase shift signal for a fundamental signal, a waveform combining section for generating a combined waveform by combining signal waveforms of the same polarity obtained by wave-rectifying the fundamental signal and the phase shift signal, a comparator section for comparing the combined waveform with a comparison threshold value, and a level shift section for shifting amplitude levels of at least any one of the fundamental signal and the phase shift signal prior to the generation of the combined waveform, as recited in claim 2, depending from amended claim 1 of the present invention.

For at least these reasons, the Applicants submit that claim 2, as amended, is allowable over the cited prior art. As claim 2 is allowable over the cited prior art, the Applicants submit that claims 8 and 9, which depend from allowable claim 2, are allowable over the cited prior art for at least the same reasons as allowable claim 2.

For all of the above reasons, it is respectfully submitted that the claims now pending patentability distinguish the present invention from the cited references. Accordingly, reconsideration and withdrawal of the outstanding rejections and an issuance of a Notice of Allowance are earnestly solicited.

Should the Examiner determine that any further action is necessary to place this application into better form, the Examiner is encouraged to telephone the undersigned representative at the number listed below.

In the event this paper is not considered timely filed, the Applicants hereby petition for an appropriate extension of time. The Commissioner is hereby authorized to charge any fee deficiency or credit any overpayment associated with this communication to Deposit Account No. 01-2300, referring to client-matter number 024016-00026.

Respectfully submitted,

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Enclosure: Petition for Extension of Time (one month)